

Pricing, Management & Optimisation of KVA

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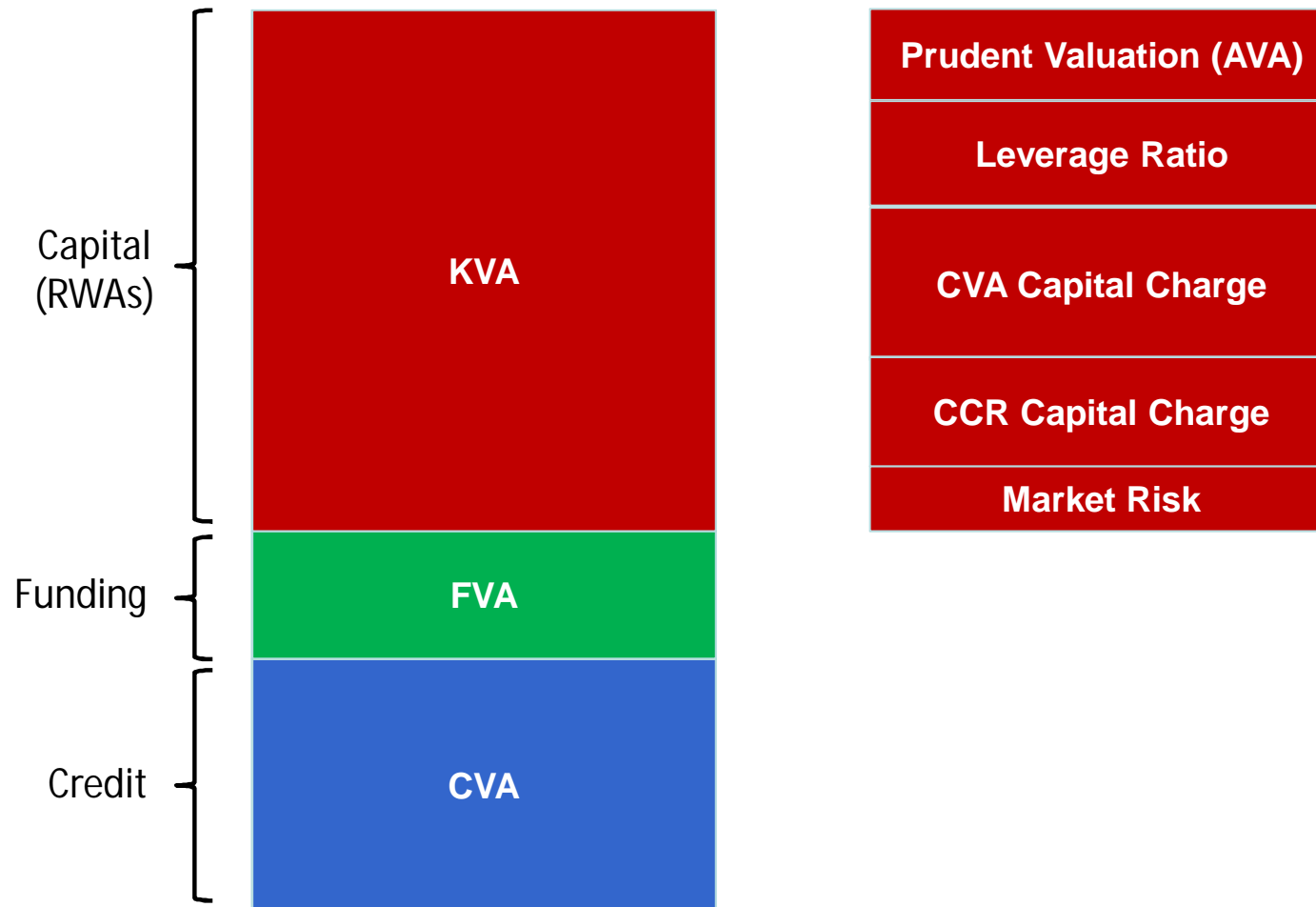
Definition and calculation of KVA

Use of KVA in pricing with other xVA components

Impact of initial margin on KVA

Impact of hedges on KVA

Regulatory Capital for Counterparty Risk



Overview of Capital Components

- **Market risk**

- Basel 2.5 currently (to be replaced by FRTB)
- Should be a small component since most risks should be hedged

- **Counterparty risk**

- Basel 2 CCR capital (default risk)
- Basel 3 CVA capital

“Overall, the EBA is of the opinion that EU exemptions on the application of CVA charges should be reconsidered or removed, since they leave potential risks uncaptured”

- **Leverage ratio**

- Minimum ratio of capital to exposure

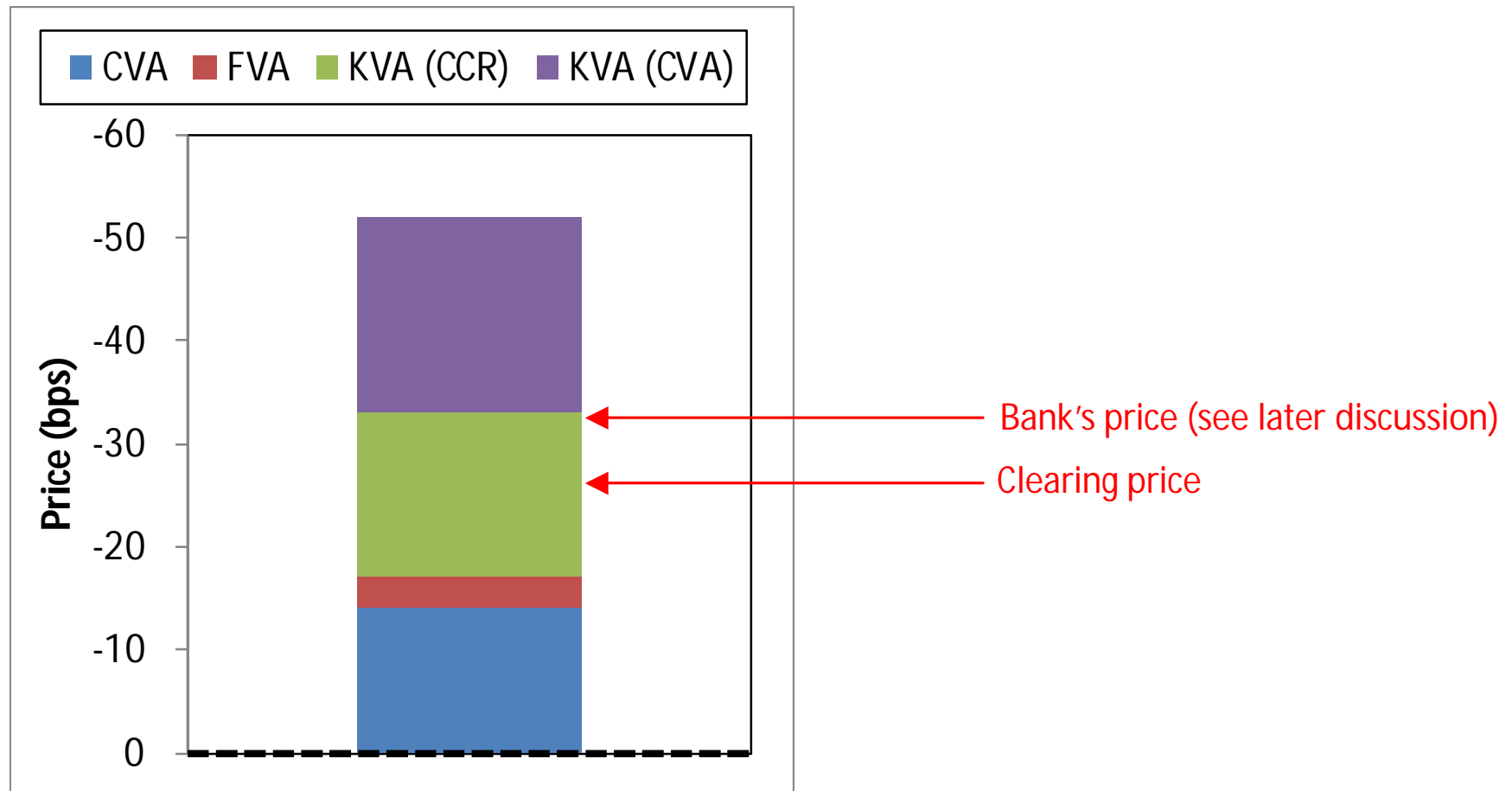
$$\text{leverage} = \frac{\text{capital}}{\text{exposure}} \geq 3\%$$

- **Prudent valuation**

- CVA uncertainty
- Funding costs

Example

- Cross-currency swap with double-B corporate (uncollateralised, no refix)



KVA (Capital Value Adjustment) Formula

$$\text{Capital}_T(t) = \text{Capital}_{CCR}(t) + \text{Capital}_{CVA}(t) + \dots$$

$$KVA = - \int_t^T ECP(u) CC(u) S_{CI}(u) du$$

Expected future capital
(discounted)

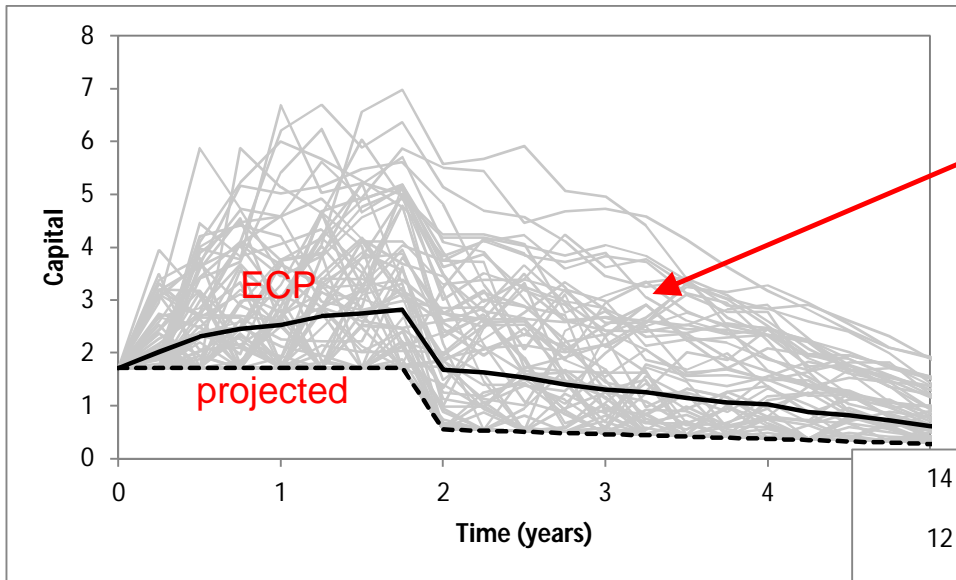
Cost of capital

Probability of no
defaults

- **Aim of KVA**

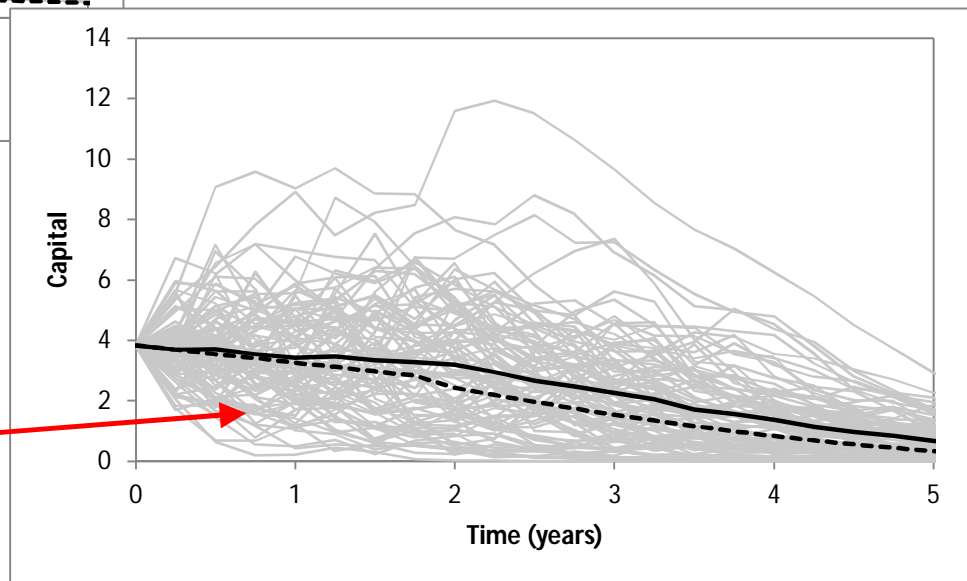
- To provide a profit that can be released over time and matches (in expectation) the cost of regulatory capital requirements

Expected Capital Profile



Standardised CVA
+ current exposure method

Advanced CVA + IMM



KVA and the Leverage Ratio

- **Leverage ratio formula**

$$\text{leverage} = \frac{\text{capital}}{\text{exposure}} \geq 3\%$$

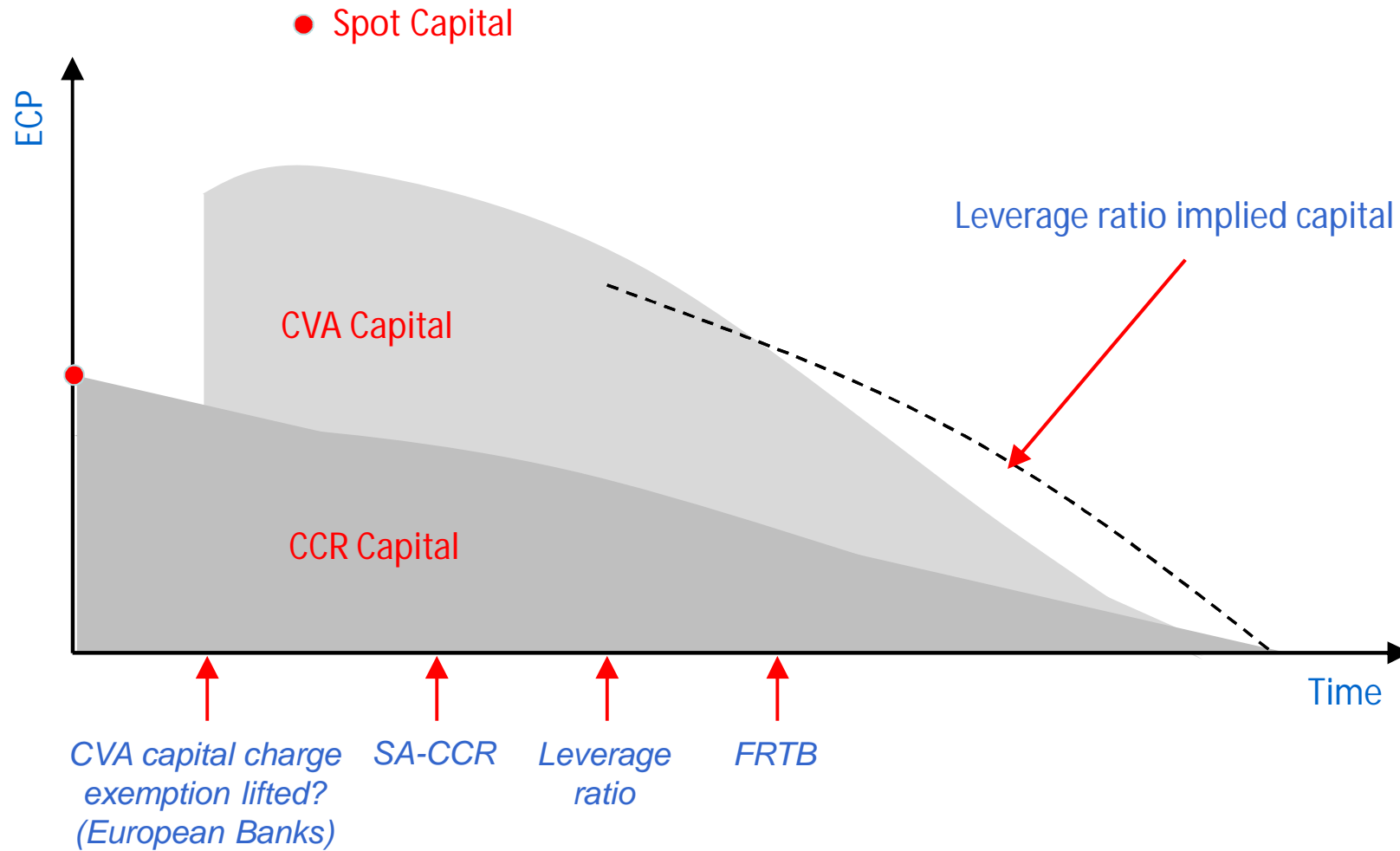
- **We therefore want the ECP to be greater than 3% of the exposure**
- **We might represent the expected capital profile to be:**

$$\text{Capital}_T(t) = \max \left[\begin{array}{l} \text{Capital}_{CCR}(t) + \text{Capital}_{CVA}(t), \\ \text{Exposure}_{LR}(t) \times 3\% \end{array} \right]$$

- **Or define leverage ratio capital as:**

$$\text{Capital}_{LR}(t) = [\text{Exposure}_{LR}(t) \times 3\% - \text{Capital}_{CCR}(t) - \text{Capital}_{CVA}(t)]_+$$

Expected Capital Profile (ECP)



Definition and calculation of KVA

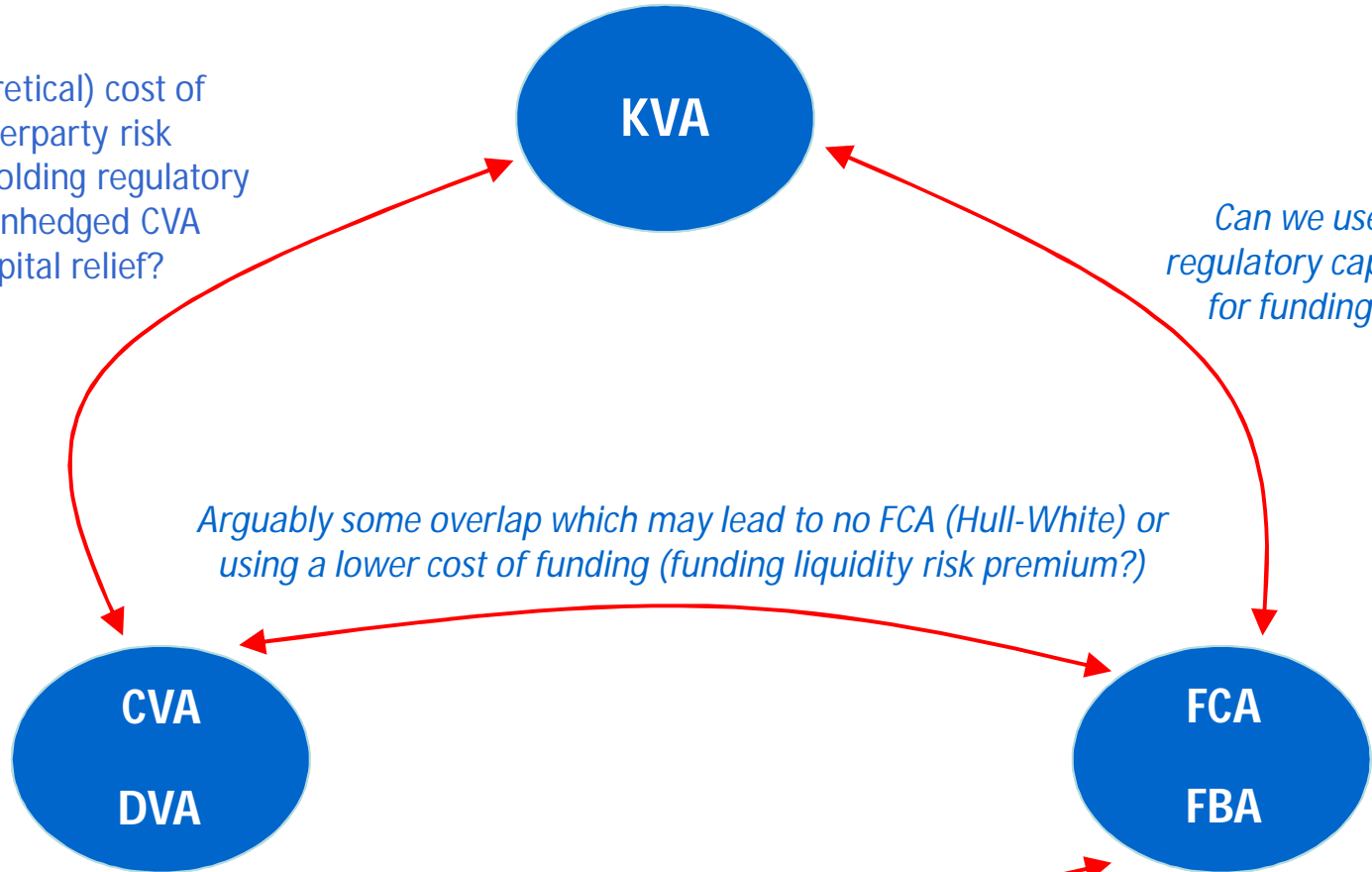
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Impact of initial margin on KVA

Impact of hedges on KVA

xVA Decomposition and Overlaps

CVA is the (theoretical) cost of hedging counterparty risk
KVA is the cost of holding regulatory capital against unhedged CVA
How much capital relief?



Can we use regulatory capital for funding?

Arguably some overlap which may lead to no FCA (Hull-White) or using a lower cost of funding (funding liquidity risk premium?)

*Double counting of DVA and FBA
what curve should we use (own CDS, own cost of funding)?*

CVA and KVA

- CVA is the theoretical cost of hedging counterparty risk
- KVA is the capital charge since we cannot (perfectly) hedge
- Banks have sometimes charged as follows:

$$\max(\underbrace{EL + KVA}_{\text{Warehousing cost}}, \underbrace{CVA}_{\text{Risk-neutral cost}})$$

- However, a CVA desk with a limits framework will likely move towards the risk-neutral cost and therefore produce zero return on capital
- A better approach is

$$CVA + \alpha KVA$$

Capital relief from hedges

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Initial Margin Exchange

- **Incoming rules for non-centrally cleared derivatives:**

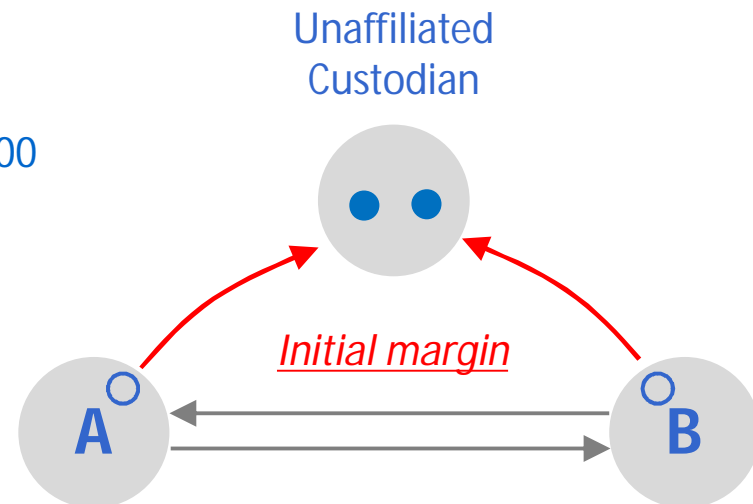
- **Variation margin**

- Bilateral full margin (zero threshold)
- Minimum transfer amount no more than €500,000
- On a regular basis (e.g. daily)
- Cash is strongly incentivised

- **Initial margin**

- Based on an extreme but plausible move based on a 99% confidence level
- 10-day time horizon (assuming variation margin is exchanged daily)
- Using quantitative (approved) model or a standardised margin schedule (no “cherry picking”)
- Margin models must be additive across asset classes (currency/rates, credit, commodities)

- **Rigorous and robust dispute resolution procedures should be in place**



Simple Example

- Surely if we take a IM against the entire portfolio to a high confidence level then the residual exposure should be small?
 - Under normal distribution assumptions, it should be reduced by a factor given by:

$$R_\alpha = [\varphi(\sqrt{\lambda}K) - \sqrt{\lambda}K\Phi(-\sqrt{\lambda}K)]^{-1} (2\pi)^{-0.5}$$

$$\lambda = \tau_{IM}/\tau_{MPR}$$

$$K = \Phi^{-1}(\alpha)$$

	$\lambda = 1$	$\lambda = 0.5$	$\lambda = 0.25$
90%	8.4	4.0	2.5
95%	19.1	6.6	3.5
99%	117.7	19.1	6.6
99.5%	252.4	29.5	8.5

Bilateral result with 10-day time horizon for IM and 99% confidence level and 20-day MPR

Overview of Counterparty Risk Capital Charges

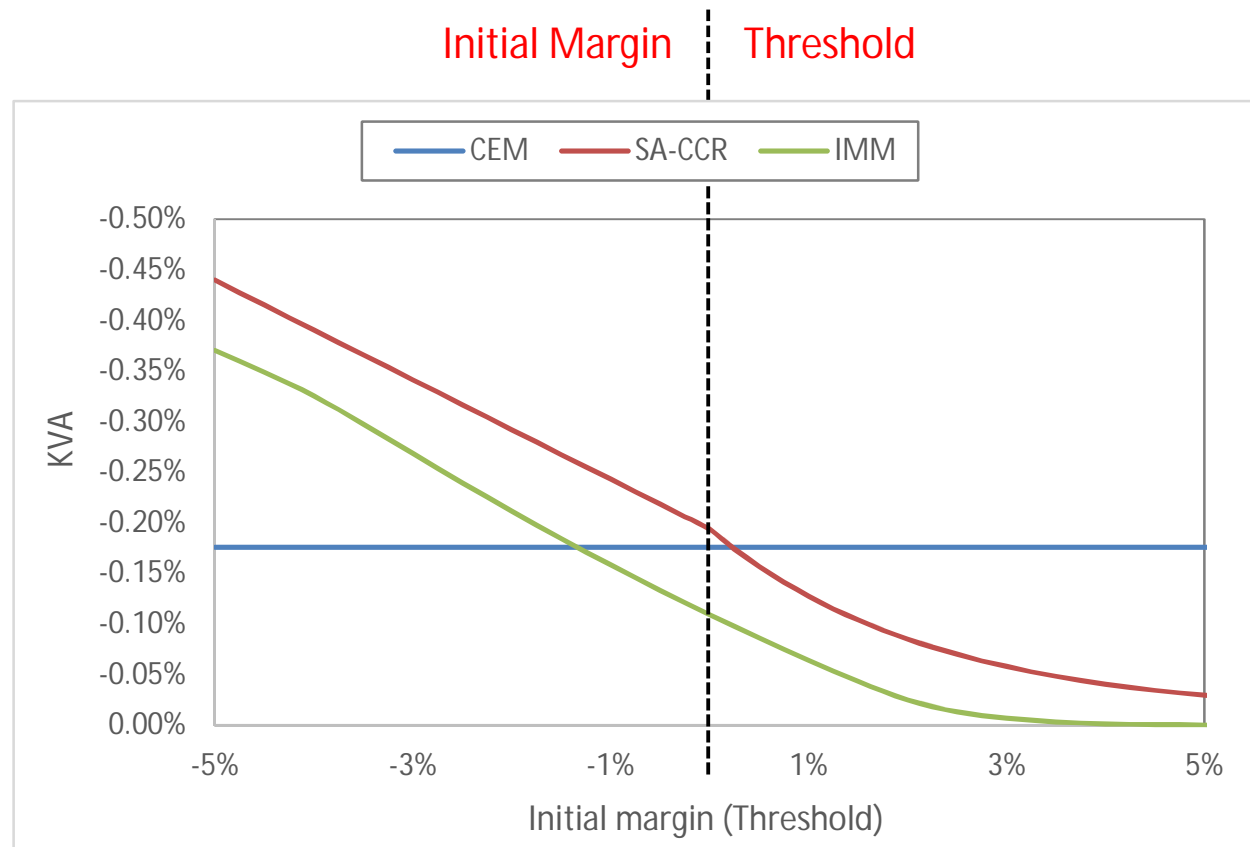
	Current	2017	Later
CCR Capital Charge	CEM or IMM	SA-CCR or IMM	SA-CCR or IMM
CVA Capital Charge	CEM / standardised or IMM / advanced	SA-CCR / standardised or IMM / advanced	BA-CVA or FRTB-CVA

KVA With Initial Margin

- **Initial margin *should* reduce KVA**
- **However, this depends on the methodology for regulatory capital**
 - Current exposure methodology (CEM): initial margin not captured
 - Internal model methodology (IMM): initial margin modelled – but how to model a risk sensitive initial margin amount?
 - SA-CCR (2017) – initial margin (fixed only) parametrised within formula and floor of 5%

KVA with Initial Margin / Threshold

Zero threshold, 10-day margin period of risk



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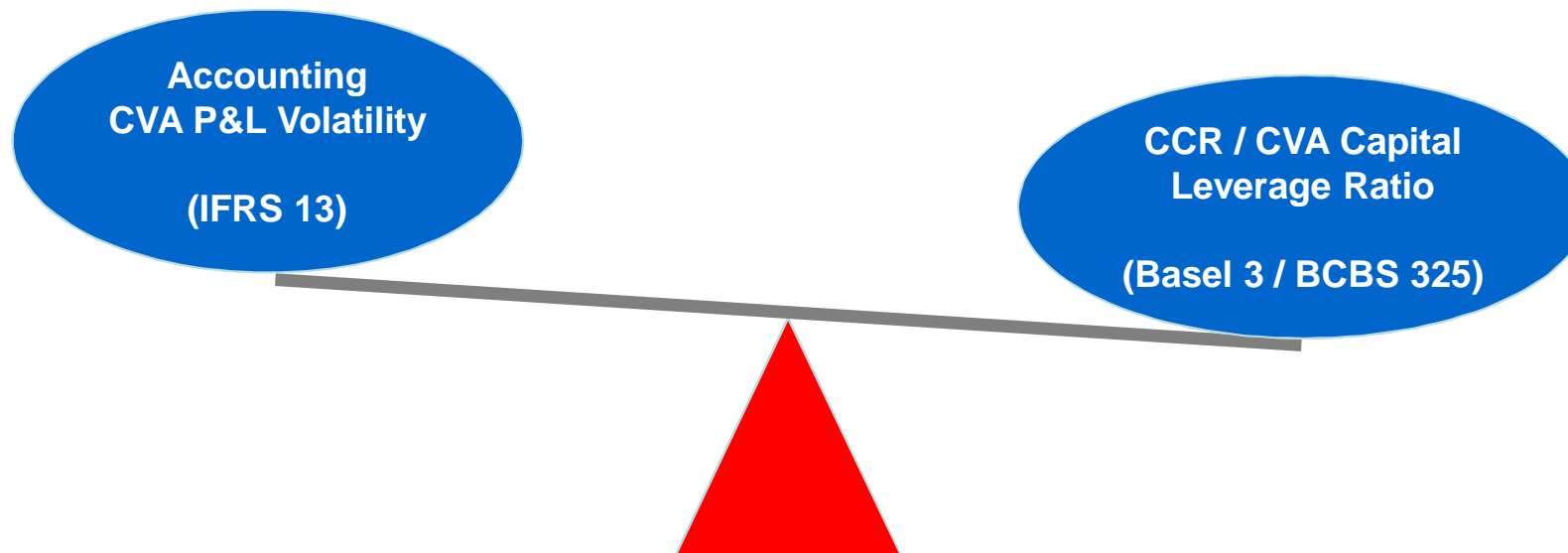
Impact of initial margin on KVA

Impact of hedges on KVA

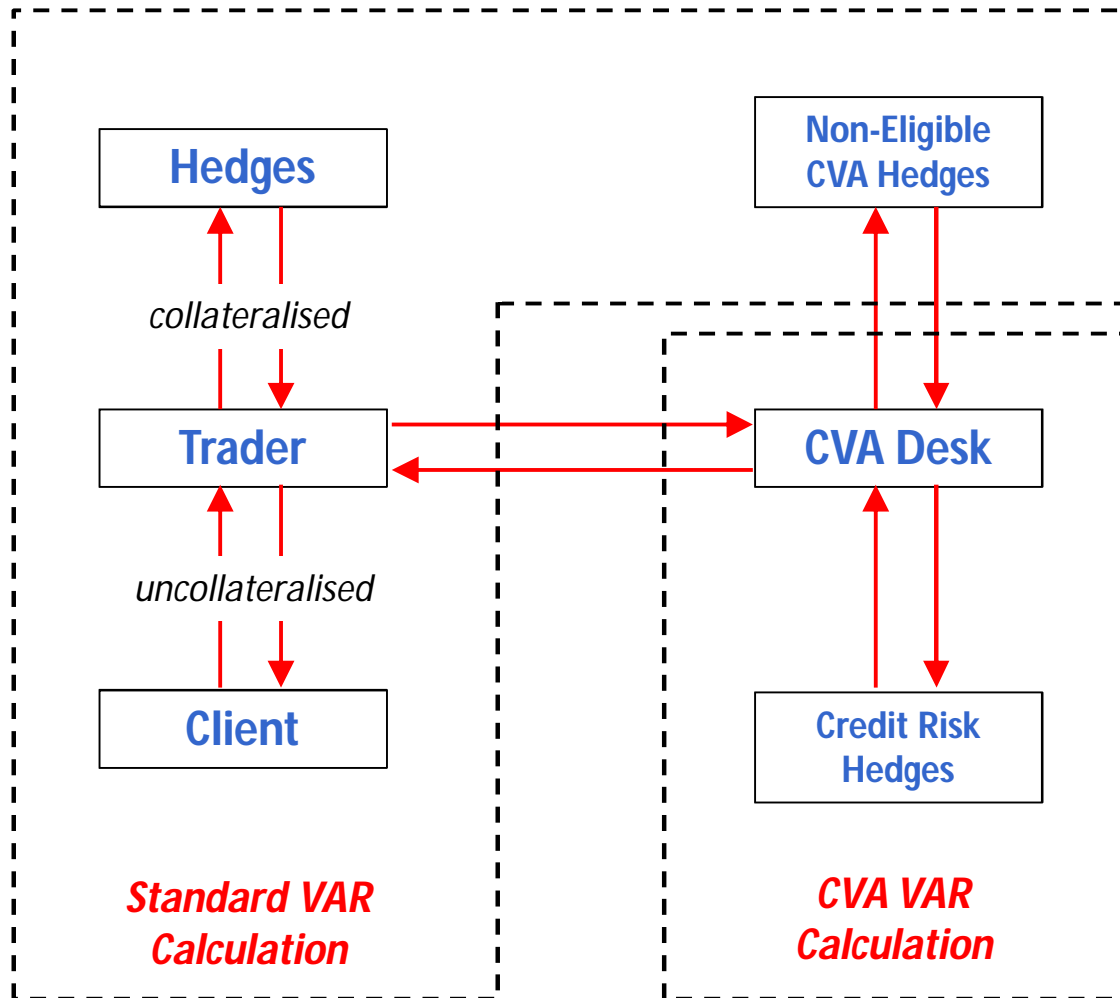
Capital and P&L Volatility

- The CVA capital charge allows some potential for for credit hedges
 - Hence, hedging can partly reduce capital requirements
 - But hedging can also reduce CVA P&L volatility
 - Not surprisingly, these don't always go hand in hand
 - Will improve under BCBS 325

*You look at it from a regulatory point of view, not an accounting point of view.
This time, our efforts to reduce risk-weighted assets have resulted in a loss.
Deutsche Bank Comment, Risk Sept 2013*



Impact of Non-Eligible Hedges on CVA Capital



- **US and Canada**

- Exemption for market risk hedges executed to reduce CVA volatility
- For some banks RWA for CVA hedges is greater than the rest of the trading book

Standardised CVA Capital Charge With CDS Hedges

$$Capital = 2.33\sqrt{h} \sqrt{\left(\rho \sum_i w_i N_i - \underbrace{\sum_{ind} w_{ind} M_{ind} B_{ind}}_{\text{Index hedges}} \right)^2 + (1 - \rho^2) \sum_i w_i^2 N_i^2}$$

Systematic term
Idiosyncratic term

Index hedges
Single name hedged notional

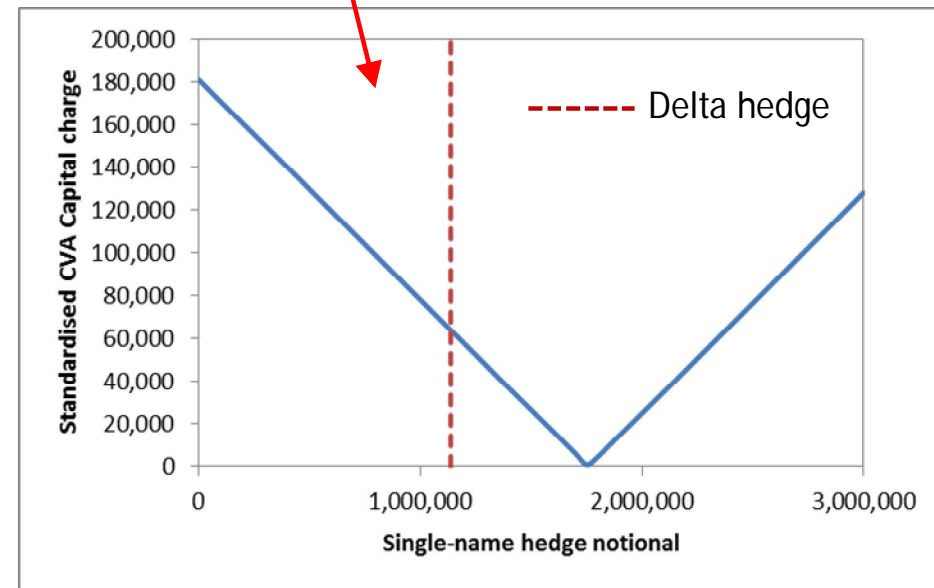
$$N_i = M_i EAD_i^{total} - M_i^{hedge} B_i$$

Effective maturities
Notional of single-name hedge

- In advanced approach CDS hedges can be modelled directly

Impact of Hedges on Counterparty Risk Capital

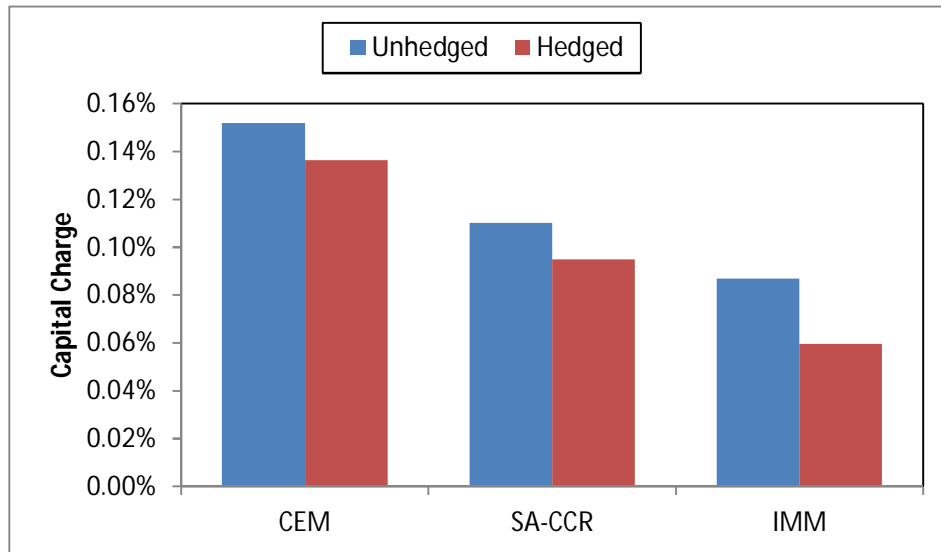
		CCR capital	CVA capital (current)	CVA capital (future)
Market risk hedges		n/a	No relief	Capital relief should be good in both SA-CVA and IMA-CVA approaches since they are sensitivity based
Credit risk hedges	Single-name CDS	Substitution / Double default	Good relief depending on approach	
	Single-name proxy CDS		No relief	
	Index CDS	No relief	Partial relief according to correlation	



KVA and Credit Hedging

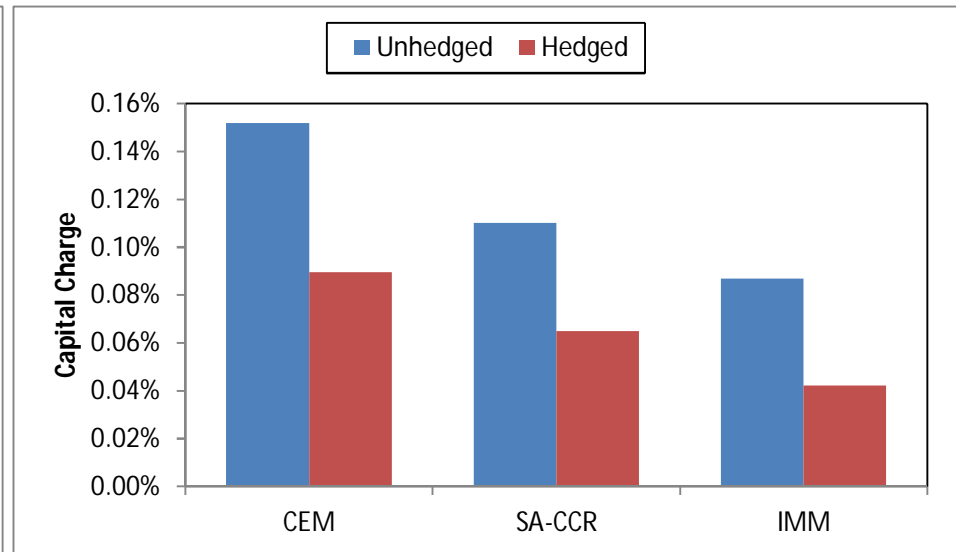
Index delta hedge

Some capital relief but not optimal
as shown on previous slide



Capital index hedge

Maximum capital relief achievable (depends
on correlation and portfolio effect)



Summary

- **Current KVA suffers from a number of problems**
 - Regulatory definition of CVA
 - Limited benefit of CVA hedges
 - European exemptions
 - Risk-neutral / real world problem
- **The FRTB-CVA approach (BCBS 325) may remedy much of this**
 - BA-CVA approach will only suit very basic banks
 - SA-CVA or IMA-CVA will likely bring better alignment and need for active management
- **Many problems still exist though**
 - Uncertain regulatory change
 - Initial margin
 - Computational challenges
 - KVA and accounting
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